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PATENT

REMARKS

In the Office Action dated April 4, 2003, the Examiner objected to the disclosure, rejected claims 1-3 as based on new matter, and rejected claims 1-3 as anticipated by the disclosure of Kim. Applicants have amended the specification as set forth above to overcome the Examiner's objection. In addition Applicant has reviewed the specification and noted that item 40 of Figure 4 is not referenced in the specification. An appropriate amendment to paragraph 25 is made to reference item 40. Applicants submit herewith the Declaration of Vin Leikus under 37 CFR 1.132 to overcome the rejection based on new matter and to clarify the differences between the claimed subject matter and the disclosure of Kim. Reconsideration of the rejections under 35 USC 112 and 102(b) is requested in view of the Declaration submitted herewith and the Remarks below.

It is requested that the Leikus declaration be entered after final action on the grounds that it addresses an issue first raised in the Final Action. Applicants invention is a switchable power divider that uses reactive, i.e. lossless, matching stubs to provide a variable impedance match for the device according to the number of ports connected. Further, the matching stubs are connected to the center conductor which is connected to the common port. The use of reactive matching stubs is advantageous in that a lower insertion loss can be provided, since there is no signal loss in the matching elements, and higher operating power can be achieved, since it is not necessary to deal with the heat generated in lossy resistive elements of the device.

The instant specification identifies the matching stubs as "reactive", thereby characterizing the stubs as being lossless. In this regard, it should be recognized that the

impedance of a circuit, particularly an RF circuit, is a combination of resistance (referred to as the "real" component of impedance) and reactance (referred to as the "imaginary" component of impedance) The matching "stubs" described in the specification and claims only have an imaginary component of impedance and hence they are referred to as "reactive". See Leikus Declaration Paragraph 1.

The Kim patent discloses a modified "Wilkinson" Power divider also known as a "radial N-way combiner", wherein resistors are switched in to provide impedance matching of the device. The disadvantage of this device is that matching is not perfect, and insertion loss suffers from the use of resistive elements. The resistive elements are also a limitation with respect to power handling of the device. See Leikus Declaration Paragraph 3.

As provided in the pending claims, the claimed device uses "reactive" matching elements which are "lossless"(as a practical matter). This is an inherent characteristic of the open circuit stubs disclosed (Liekus Declaration Para. 2). Further, as specified in the amended claims, the matching elements are arranged to connect to the center conductor connected to the common port. In the Kim arrangement, the matching resistors are connected to the individual switched ports.

Further, the Examiner's comments concerning the added claim limitations relating to the fact that the matching elements connect to the "center conductor" misinterpret the limitation or the Kim structure. It is agreed that Kim has a center conductor 34 connected to a common port 32. However the matching elements of Kim are not arranged to connect to that center conductor, as specified in the claims.

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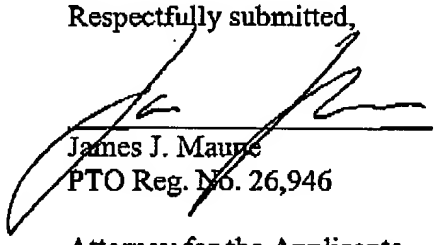
Concerning the term "lossless", reference is made to the Leikus Declaration Paragraph 3. The term lossless is used to characterize the matching elements, not the power divider. Accordingly the fact that one attempts to minimize insertion loss of the device as a whole does not mean that the matching elements of Kim are lossless, particularly where they include resistors to dissipate unbalanced energy, as set forth in the Leikus Declaration.

Accordingly, the invention claimed is clearly distinguished over the Kim reference and this application is believed to be in condition for allowance, which action is respectfully urged.

Attached hereto is a **VERSION WITH MARKINGS TO SHOW CHANGES MADE.**

Respectfully submitted,



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VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the Specification:

[0019] Those familiar with RF circuits will recognize that in a conventional system of the type shown in Figure 1, proper operation requires that all amplifiers 16A-16D be operating to normal specification, with equal amplifier power and phase. In the event one of the amplifiers, such as amplifier 16C, should fail, the result will be a possible impedance mismatch at divider 14 and a power combining impedance mismatch at combiner 18. The resulting signal loss will exceed the 1/4 power loss normally associated with the failed amplifier, because of the impedance mismatch at the combiner. In the event that one of amplifiers 16 fails, or in the event that it is desired to disconnect one of the amplifiers 16, it is desirable to reconfigure power divider 14 and power combiner 18 to isolate the failed amplifier 16C from the other elements of the system.

[0020] Figure 2 is a schematic diagram of a conventional single-pole, N-throw (N=4) RF switch 22 having a signal input port 23 and switch selectable output portions 25A, 25B, 25C and 25D. In normal applications the switch reeds 24A, 24B, 24D and 24D are moved to connect only one of the output ports 25A-25D to the input port 23. Because there is only a single connection at any time (except possibly during the switching process), assuming the load on the connected output ports 25A-25D is equal to the characteristic impedance of the transmission line and source 23, impedance match is achieved.

[0021] If more than one of the output ports 25A-25D of switch 22 were connected, the input impedance at input port 23 will be a function of the impedance of all connected output ports. Accordingly, assuming that the output ports are 50 ohm loads, and two output ports are

connected, the impedance at input port 23 will be 25 ohms. If all switch reeds 24A-24D are moved to the connected position, and 50 ohm loads are provided at each output port, the impedance of input port 23 will be 12-1/2 ohms. Accordingly, activation of more than one switch reed 24A-24D will normally cause a significant change in the input impedance, normally causing a mismatch and power loss by reflection.

[0023] The inner conductor portions shown in Figure 3 include a common input port 33, which is connected to a 50 ohm slab-line inner conductor 36 to be mounted within housing 42, as shown in Figures 4 and 5. Coaxial output ports 35A, 35B, 35C and 35D connect inner conductor 36 selectively to one or more of output ports 35A-35D. According to the number of output ports connected, an input signal provided to input port 33 is provided as an output signal to one or more output ports 35. Reeds 34A, 34B, 34C and 34D are mechanically moved between open or "off" positions and closed or "on" positions by electromagnets in a conventional manner as will be further explained.

[0024] Those skilled in the art will recognize that when a single output port 35A-35D is connected to input port 33 by one of switching reeds 34A-35D, the load presented to input port 33 is a match, i.e., 50 ohm, impedance load. As additional output ports 35 are connected by switching of their respective switch reeds 34A-34D, provisions must be made for impedance matching the input port 33 to the changed load condition.

[0025] To provide for impedance matching, switchable matching stub reeds 37, 38 and 39 are respectively located at selected distances D1, D2 and D3 along slab transmission line 36 from the switching connection point. Each impedance matching reed 37, 38, and 39 has a

respective impedance matching length L1, L2 and L3, which is selected to provide reactive impedance matching for the power divider when 2, 3 or 4 of output ports 35A-35D are connected to transmission line 36 by their respective switching reeds 34. **Solenoids as shown in Figures 6 and 7 are arranged to move switchable matching reeds 37, 38 and 39 between a "down" position contacting center conductor 36 and mechanical rest 40 and an "up" position away from the center conductor 36.**

[0034] As an additional feature, it is possible to provide a power amplifier system which will have a "fail soft" characteristic. Monitor couplers 72A, 72B, 72C and 72D are provided at the output of each individual amplifier 16A-16D, and the monitor signal is provided to detectors 74. Control logic 76 responds to a failure of any of amplifiers 16 to discontinue operation of that amplifier, and reconfigure power divider 14 and power combiner 18 for operation with the remaining three amplifiers. Accordingly, the amplifiers continues to function with reduced power output.